

Gender Differences in Smoking Cessation after 3 Years in the Lung Health Study

ABSTRACT

Objectives. An analysis of gender differences in smoking cessation was conducted among 3923 participants in the Special Intervention group of the Lung Health Study. This report focuses on gender differences in sustained quit rates at 12 and 36 months.

Methods. Special Intervention participants were offered a 12-session, 12-week smoking cessation program using nicotine gum and were followed for 3 years. Self-reported smoking status was validated with carbon monoxide and salivary cotinine.

Results. Men had higher sustained quit rates at 12 and 36 months; gender differences were found in baseline variables that also predicted sustained abstinence; and controlling for selected baseline variables reduced the association between gender and sustained abstinence. When other variables were controlled, gender predicted sustained abstinence at 36 months (odds ratio [OR] = 1.24, 95% confidence interval [CI] = 1.04, 1.48) but not 12 months (OR = 1.08, 95% CI = 0.92, 1.27), reflecting more late relapse among women.

Conclusions. Demographics and smoking history were more important than gender per se in sustained smoking cessation in the Lung Health Study. Programs tailoring smoking cessation by gender need to include coping skills for problems associated with less education and social support and for improving persistence with quit attempts. (*Am J Public Health.* 1995;85:223–230)

Wendy Bjornson, MPH, Cynthia Rand, PhD, John E. Connett, PhD, Paula Lindgren, MS, Mitchell Nides, PhD, Frances Pope, MSW, A. Sonia Buist, MD, Charisse Hoppe-Ryan, MSW, and Peggy O'Hara, PhD, for The Lung Health Study Research Group

Introduction

The 1980 surgeon general's report on the health consequences of smoking for women concluded that women have more difficulty quitting smoking than men. This conclusion, drawn from reviews of formal cessation studies, showed significant gender differences in quit rates both at the end of treatment and at longer term follow-up points.¹

The 1980 report initiated a decade of research investigating the smoking "gender gap." During this time, health consequences of smoking for women were better documented, trends in smoking initiation and cessation were identified, differences in factors affecting smoking cessation were researched, and new intervention strategies were developed.² Some investigators ascribed reasons for the gender gap to women having less confidence in their ability to quit smoking^{1,3}; differences in the use and effects of nicotine,⁴ possibly resulting in differences in nicotine intake and withdrawal symptoms⁵; differences related to concerns about postcessation weight gain⁶; or greater reliance by women on smoking as a coping aid.² Other investigators noted that while women may be less likely to quit than men, this difference is strongly associated with socioeconomic status, with gender differences larger among less educated adults.⁷

Although the proportion of men who smoke is greater at present, men are quitting at a faster rate.⁸ On the basis of current trends, the proportion of women who smoke will be greater by the year 2000.⁹ This means that the toll in smoking morbidity and mortality among women

will remain high and continue to rise, for some diseases, into the next century.

Some gender differences in smoking cessation continue to be observed, although the smoking and smoking cessation behavior of men and women has become more similar.¹⁰ In particular, gender differences continue in formal treatment programs.¹¹ Each year, an estimated 2 million smokers—especially women, heavier smokers, middle-aged smokers, and those unsuccessful in past quit attempts¹²—turn to formal programs for help. Investigating gender differences in smoking treatment programs, especially for smokers at an increased risk for smoking-related diseases, remains of particular interest in the effort to reduce smoking morbidity and mortality.

In 1986, the National Heart, Lung, and Blood Institute began a 5-year clinical

Wendy Bjornson and A. Sonia Buist are with the Department of Physiology, Oregon Health Sciences University, Portland. Cynthia Rand is with the Division of Pulmonary and Critical Care Medicine, Johns Hopkins School of Medicine, Baltimore, Md. John E. Connett and Paula Lindgren are with the Division of Biostatistics, School of Public Health, University of Minnesota, Minneapolis. Mitchell Nides is with the Division of Pulmonary Medicine, School of Medicine, University of California at Los Angeles. Frances Pope is with the Division of Pulmonary Medicine, University of Pittsburgh, Pittsburgh, Pa. Charisse Hoppe-Ryan is with the Division of Pulmonary and Critical Care Medicine, Henry Ford Health System, Detroit, Mich. Peggy O'Hara is with the Department of Epidemiology and Public Health, University of Miami School of Medicine, Miami, Fla.

Requests for reprints should be sent to Wendy Bjornson, MPH, Oregon Health Sciences University, 3181 SW Sam Jackson Park Rd L334A, Portland, OR 97201.

This paper was accepted June 6, 1994.

trial designed to evaluate the efficacy of early intervention for chronic obstructive pulmonary disease among cigarette smokers with mild to moderate pulmonary function impairment. The design and recruitment for this trial have been described elsewhere.^{13,14} The objective of the Lung Health Study was to determine whether an intervention program incorporating smoking cessation and prescription of an inhaled bronchodilator (ipratropium bromide) could slow the rate of decline in 1-second forced expiratory volume in smokers with early chronic obstructive pulmonary disease. The rate of lung function decline was expected to be least among participants who sustained smoking cessation throughout the trial. The purposes of this paper are to investigate the relationship of gender to sustained smoking cessation 12 and 36 months after entry into the Special Intervention group of the Lung Health Study, to investigate the relationship of gender to other baseline variables, and to investigate the effect of baseline variables, including gender, as predictors of sustained smoking cessation.

Methods

Participants

A total of 5887 participants were randomized into the Lung Health Study (3923 into the Special Intervention group). Participants were cigarette smokers, 35 to 60 years of age at time of entry, with borderline to moderate airflow obstruction (defined as a ratio of 1-second forced expiratory volume to forced vital capacity of less than .7, together with a baseline 1-second forced expiratory volume that was 55% to 90% of the value predicted for the participant's age, sex, height, and race). Exclusion criteria included health conditions likely to affect lung function, such as lung cancer, recent heart attack, or stroke; the use of bronchodilators; excessive alcohol use; present or recent treatment for alcohol abuse; pregnancy or intention to become pregnant; and other conditions that would interfere with participation. Willingness to enter a smoking cessation program and to participate in a 5-year trial were key inclusion criteria. Participant baseline characteristics, spirometry methods, and intervention methods have been described in detail elsewhere.¹⁵⁻¹⁷

Ninety-five percent of all Special Intervention participants attended the 12-month visit; 89% attended the 36-month visit. As a result of missing values

on data collection forms, 89% (3487) of the Special Intervention participants are included in the 12-month analysis, and 84% (3283) are included in the 36-month analysis.

Procedures

Special Intervention participants were strongly encouraged to enter the Lung Health Study's intensive, group smoking-cessation program. The smoking cessation program included a strong physician message to stop smoking; a 12-week, 12-session cognitive-behavioral group program; Nicorette gum (Marion Merrell Dow Pharmaceutical), the use of which was strongly encouraged, provided at no charge; and a follow-up maintenance program.

Consistent with the protocol, none of the Lung Health Study centers provided gender-specific programs during the initial intervention program, although some provided relapse programs specifically for women.

Special Intervention participants attended follow-up visits every 4 months to assess self-reported smoking status, end-tidal expired carbon monoxide, inhaler use, nicotine gum use, and any side effects to the inhaled medication or nicotine gum. Pulmonary function tests and respiratory symptom history were completed annually.

Measures

Baseline screening visits included questions about demographics, past and present tobacco use, family smoking history, nicotine dependence, use of alcohol, and past and present illness and respiratory symptoms. Other measures included body weight, carbon monoxide, salivary cotinine for self-reported nonsmokers, and pulmonary function testing.

Carbon monoxide and salivary cotinine were used to validate self-reported nonsmoking status at annual follow-up visits. A sustained nonsmoker at the 12-month visit reported not smoking at the time of the visit, reported not smoking any tobacco in the previous 8 months, and had a salivary cotinine level of 20 ng/ml or less or, if using nicotine gum, carbon monoxide values less than 10 ppm. A sustained nonsmoker at the 36-month visit was a sustained nonsmoker at the 12-month visit and met the criteria for sustained nonsmoker at the 24- and 36-month visits (i.e., had not smoked tobacco at the time of the visit or in the previous 12 months and met the cutoff levels for cotinine or carbon monoxide).

Participants who missed the 12- and/or 24-month visits but attended the 36-month visit were classified as smokers.

The cotinine and carbon monoxide cutoff levels were based on commonly accepted levels in the literature. The relationship between cotinine, carbon monoxide, and self-reported quit rates in the Lung Health Study has been reported elsewhere.¹⁸

Statistical Analysis

Seventeen baseline variables were used to compare gender differences at baseline and were used in the univariate and multivariate analyses to predict sustained nonsmoking and differences in sustained nonsmoking by gender at 12 and 36 months. Included in the baseline variables were four factors related to nicotine dependence derived from 10 questionnaire items submitted to a principal-components factor analysis.¹⁹ The four factors were (1) smoking in response to negative affect (3 questions involving smoking when "blue," smoking when angry, and smoking when tense or upset), labeled the "emotional" factor (score range 3-12); (2) awareness of nicotine deprivation (3 questions involving finding it unbearable to run out of cigarettes, having a gnawing hunger for cigarettes when not smoking for a while, and thinking about smoking when not smoking), labeled the "awareness" factor (score range 3-12); (3) physical dependence (3 questions involving smoking when ill in bed, smoking at night after going to bed, and smoking in places where smoking is forbidden), labeled the "dependence" factor (score range 0-3); and (4) morning smoking behavior, labeled the "minutes to first cigarette" factor (score range 0-720).

In baseline comparisons, *t* tests were used for means of continuous variables, and chi-square tests were used for categorical variables.¹⁸ Each baseline variable was dichotomized into two strata to allow comparisons of the independent effects of gender on sustained smoking cessation within each stratum at 12 and 36 months (see Tables 2 & 3). Sustained quit rates (at 12 and 36 months) were computed for men and women separately within each covariate-defined stratum and were compared by means of Yates-corrected chi-square tests. Relative risk ratios of smoking cessation for male versus female gender were computed within each stratum. Logistic models were used in tests for interaction of gender with the stratifying variables. No adjustment

was made in these models for multiple comparisons. As a means of comparing the independent effect of all variables (including gender), all baseline variables were then entered into stepwise logistic regression models, and odds ratios, confidence intervals, and *P* values were determined.¹⁸ Gender was included in all models, and a .05 significance level was used for entry of the other variables in the models.

Results

Of 3923 participants randomized into the Special Intervention group, 63% were male; the average age at entry was 48.5 years for both genders. Participants were 95% White, nearly 60% had completed some college or technical school, and more than 70% were married. Participants smoked an average of 31 cigarettes per day at baseline and had average cotinine levels of 365 ng/ml. Ninety-one percent of Special Intervention participants enrolled in the smoking cessation program, attending at least the orientation session. At 12 months, 27% (*n* = 1069) of all participants were sustained nonsmokers (29% [*n* = 703] of the men and 25% [*n* = 366] of the women). At 36 months, 21% (*n* = 805) of all participants were sustained nonsmokers (22% [*n* = 542] of the men and 19% [*n* = 263] of the women).

Baseline Comparisons by Gender

Table 1 shows significant gender differences among 14 of the 17 baseline variables considered. Men tended to be better educated, had a higher average body mass index, and were more likely to be married. Men were more likely to have made more previous quit attempts, to have smoked more years, and to have made longer quit attempts; women were more likely to have used nicotine gum before, to have other smokers in the household, and to consume fewer alcoholic drinks per week. There were also significant differences in five of the seven nicotine dependence variables: women averaged fewer cigarettes per day and had lower cotinine levels, and men had lower average scores on the awareness, emotional, and nicotine dependence factors.

Univariate Analysis of Gender Differences at 12 and 36 Months

Tables 2 and 3 show sustained quit rates at 12 and 36 months for Special Intervention men and women within each stratum. The overall relative risk for

TABLE 1—Baseline Gender Comparisons for Special Intervention Participants

	Men (<i>n</i> = 2448)	Women (<i>n</i> = 1475)	<i>P</i>
Demographics			
Education greater than high school, %	61.1	51.3	< .0001
Married, %	78.1	61.8	< .0001
Average age, y (> 50 y, %)	48.5 (7.0)	48.5 (6.5)	.76
Mean body mass index, kg/m ² (SD)	26.4 (3.6)	24.1 (4.0)	.0001
Smoking history			
More than 3 previous quit attempts, %	51.6	44.1	< .0001
No. of years smoked, mean (SD)	31.4 (7.7)	30.4 (7.0)	.0001
Prior longest quit attempt of more than 6 mo, %	27.6	22.9	.002
Used nicotine gum before, %	34.1	42.4	< .0001
Other smokers in household, %	38.5	42.0	.03
Health behaviors: no. of alcoholic drinks per week, mean (SD)	4.9 (6.0)	3.4 (4.7)	.0001
Nicotine dependence			
No. of cigarettes per day at baseline, mean (SD)	32.8 (13.1)	29.0 (11.9)	.0001
Baseline cotinine, ng/ml (SD)	380.0 (209.6)	348.7 (186.7)	.0001
First cigarette of day most difficult to give up, ^a %	47.2	50.2	.07
No. of minutes to first cigarette of day, mean (SD)	25.0 (50.7)	25.5 (66.5)	.80
Awareness factor ^a score, mean (SD)	8.4 (2.0)	8.9 (2.0)	.0001
Emotional factor ^a score, mean (SD)	8.2 (2.1)	9.5 (2.0)	.0001
Dependence factor ^a score, mean (SD)	0.9 (0.9)	1.1 (0.9)	.0001

Note. Percentages were analyzed with chi-square tests; means were analyzed with *t* tests.
^aSee text for detailed definition.

sustained quitting at 12 months for men vs women was 1.15 (*P* = .008). There were significant gender differences in sustained quit rates in one of the strata for 13 of the 17 variables. The variables indicating that men were significantly more likely than women (*P* ≤ .01) to be sustained nonsmokers at 12 months were education less than or equal to high school, longest previous quit attempt less than 6 months, having another smoker in the household, consuming more than seven drinks per week, smoking more than 30 cigarettes per day at baseline, finding the first cigarette of the day the most difficult to give up, and having a lower score on the awareness and nicotine dependence factors.

At 36 months, the overall relative risk was 1.24 (*P* = .001). All of the variables involved significant gender differences in one or both strata, and six additional variables involved the most significant differences (*P* ≤ .01): age at baseline equal to or greater than 50 years, body mass index greater than 25, smoking greater than or equal to 30 years, baseline cotinine greater than 350 ng/ml, smoking the first cigarette less than or equal to 30 minutes after waking, and having a lower score on the emotional factor.

There was some suggestion of interaction of several of the variables with gender in predicting smoking cessation. However, the interaction was statistically significant only for alcohol consumption.

TABLE 2—Sustained Validated Quit Rates, by Stratified Baseline Variables at 12 Months, and Relative Risks of Sustained Quitting for Men vs Women

	Women within Strata, %	Quit Rate, %		Nominal <i>P</i> (Men vs Women)	Relative Risk (Men vs Women)	<i>P</i> for Interaction
		Women	Men			
Gender (male = 1, female = 0)	37	25	29	.008	1.15	. . .
Demographic variables						
Education						
≤ high school	43	21	27	< .01	1.27	.13
> high school	34	28	30	.43	1.06	
Marital status						
Not married	51	22	25	.19	1.16	.85
Married	32	27	30	.10	1.11	
Age, y						
< 50	38	23	27	.06	1.16	.61
≥ 50	38	26	31	.06	1.16	
Body mass index, kg/m ²						
≤ 25	51	24	26	.43	1.07	.54
> 25	24	26	30	.07	1.16	
Smoking history variables						
No. of previous quit attempts						
< 3	41	25	29	.10	1.13	.68
≥ 3	34	24	29	.03	1.19	
No. of years smoked						
< 30	39	24	28	.12	1.14	.73
≥ 30	37	25	30	.03	1.17	
Longest quit attempt, mo						
≤ 6	39	23	28	.01	1.19	.09
> 6	33	40	33	.11	0.82	
Used Nicorette before						
No	35	27	30	.08	1.12	.80
Yes	43	22	26	.10	1.17	
Other smoker in house						
No	36	27	29	.28	1.08	.12
Yes	40	22	29	.01	1.29	
Health behaviors						
No. of drinks per week						
≤ 7	41	26	28	.18	1.08	.02
> 7	27	18	30	< .01	1.70	
Nicotine dependence						
No. of cigarettes per day at baseline						
≤ 30	43	26	29	.14	1.10	.48
> 30	29	21	28	< .01	1.33	
Cotinine, ng/ml						
≤ 350	41	26	30	.03	1.16	.61
> 350	34	23	27	.07	1.17	
Most difficult cigarette to give up						
First in morning	39	23	29	< .01	1.28	.11
Other	36	27	29	.40	1.07	
No. of minutes to first cigarette						
≤ 30	39	24	28	.03	1.14	.77
> 30	31	28	33	.19	1.18	
Awareness factor ^a score						
≤ 8	32	22	29	< .01	1.29	.10
> 8	43	27	29	.33	1.07	
Emotional factor ^a score						
≤ 8	26	23	29	.02	1.24	.34
> 8	49	26	29	.13	1.13	
Dependence factor ^a score						
≤ 1	37	25	29	< .01	1.19	.42
> 1	41	25	27	.59	1.06	

Note. *P* values were not adjusted for multiple comparisons.^aSee text for detailed definition.

TABLE 3—Sustained Validated Quit Rates, by Stratified Baseline Variables at 36 Months, and Relative Risks of Sustained Quitting for Men vs Women

	Women within Strata, %	Quit Rate, %		Nominal <i>P</i> (Men vs Women)	Relative Risk (Men vs Women)	<i>P</i> for Interaction
		Women	Men			
Gender (male = 1, female = 0)	37	18	22	.001	1.24	. . .
Demographic variables						
Education						
≤ high school	43	15	21	< .01	1.40	.10
> high school	34	21	23	.21	1.11	
Marital status						
Not married	51	15	19	.11	1.24	.82
Married	32	20	23	.03	1.18	
Age, y						
< 50	38	17	21	.04	1.21	.69
≥ 50	38	19	24	.01	1.27	
Body mass index, kg/m ²						
≤ 25	51	18	20	.18	1.13	.61
> 25	24	18	23	.01	1.32	
Smoking history variables						
No. of previous quit attempts						
< 3	41	18	23	.01	1.26	.82
≥ 3	34	18	22	.04	1.22	
No. of years smoked						
< 30	39	17	21	.05	1.22	.88
≥ 30	37	18	23	.01	1.26	
Longest quit attempt, mo						
≤ 6	39	17	21	.01	1.26	.08
> 6	33	31	26	.21	0.84	
Used Nicorette before						
No	35	20	24	.05	1.17	.45
Yes	43	15	19	.02	1.32	
Other smoker in house						
No	36	19	22	.15	1.13	.09
Yes	40	16	23	< .01	1.43	
Health behaviors						
No. of drinks per week						
≤ 7	41	19	22	.08	1.14	< .01
> 7	27	11	23	< .01	2.21	
Nicotine dependence						
No. of cigarettes per day at baseline						
≤ 30	43	19	22	.07	1.15	.14
> 30	29	14	22	< .01	1.56	
Cotinine, ng/ml						
≤ 350	41	20	23	.08	1.16	.09
> 350	34	15	22	< .01	1.41	
Most difficult cigarette to give up						
First in morning	39	17	22	< .01	1.33	.37
Other	36	19	22	.08	1.17	
No. of minutes to first cigarette						
≤ 30	39	17	21	< .01	1.25	.66
> 30	31	22	25	.36	1.15	
Awareness factor ^a score						
≤ 8	32	17	22	< .01	1.34	.88
> 8	43	19	22	.07	1.18	
Emotional factor ^a score						
≤ 8	26	16	23	< .01	1.39	.69
> 8	49	19	21	.12	1.15	
Dependence factor ^a score						
≤ 1	37	18	23	< .01	1.28	.95
> 1	41	18	21	.28	1.15	

Note. *P* values were not adjusted for multiple comparisons.

^aSee text for detailed definition.

TABLE 4—Predictors of Validated Sustained Smoking Cessation

	Odds Ratio	95% Confidence Interval	P
Predictors at 12 months			
Gender ^a	1.08	0.92, 1.27	.4
Education ^b	1.29	1.11, 1.50	.001
Married ^c	1.30	1.09, 1.54	.003
Age ^d	1.17	1.05, 1.30	.006
Longest previous quit attempt ^e	1.44	1.21, 1.70	.0001
Used Nicorette before ^f	0.79	0.68, 0.92	.003
Body mass index	1.03	1.01, 1.05	.005
Predictors at 36 months			
Gender ^a	1.24	1.04, 1.48	.02
Education ^b	1.27	1.07, 1.50	.005
Married ^c	1.37	1.13, 1.66	.001
Age ^d	1.21	1.07, 1.36	.002
Longest previous quit attempt ^e	1.40	1.16, 1.68	.0004
Used Nicorette before ^f	0.75	0.63, 0.88	.0007
Cotinine ^g	0.96	0.92, 0.99	.03

^a1 = male, 0 = female.

^b1 = greater than high school, 0 = high school or less.

^c1 = married, 0 = not married.

^dIntervals of 10 years.

^e1 = less than 1 week, 2 = 1–4 weeks, 3 = 1–6 months, 4 = 7–12 months, 5 = greater than 1 year.

^f1 = yes, 0 = no.

^gIntervals of 100 ng/ml.

Predictors of Sustained Nonsmoking at 12 and 36 Months

Table 4 shows the odds ratios, 95% confidence intervals, and significance levels from the stepwise logistic regression analysis. In this adjusted analysis, gender was not a significant predictor of sustained nonsmoking at 12 months. However, at 36 months, even with adjustment for baseline variables, male gender was a significant predictor of sustained nonsmoking. In the 36-month analysis, lower cotinine levels emerged as a predictor, and baseline body mass index was no longer significant. Since the adjusted analyses indicated that gender was a predictor of sustained nonsmoking at 36 months but not at 12 months, relapse rates between 12 and 36 months for sustained nonsmokers at 12 months were analyzed. We found that the relapse rate for women was significantly greater than that for men (28% vs 23%; $P < .05$).

Discussion

The Lung Health Study, with its more than 3900 Special Intervention participants, has been the largest trial to evaluate the long-term efficacy of a structured smoking cessation program in initi-

ating and sustaining smoking cessation in both men and women. This study observed significant differences in sustained cessation rates at 12 and 36 months, with men having higher cessation rates.

Our finding that women have greater difficulty than men in quitting smoking is consistent with previous investigations.¹ Our analysis suggests that gender alone explained only some of the differences in sustained smoking cessation and that gender differences in baseline demographic and smoking history variables also proved to be important predictors of smoking cessation. Specifically, within each gender group, participants in the Lung Health Study who were better educated, married, older, had made longer quit attempts in the past, had not used Nicorette before, and had a higher body mass index or lower cotinine level were more likely to be sustained nonsmokers. Women in the study were less well educated than men, were less likely to be married, had made shorter quit attempts in the past, and were more likely to have used Nicorette before.

To better explain the overall results, we analyzed the gender effect separately for each variable. Consistent with Pierce et al., we found education level to be

strongly related to smoking cessation at both 12 and 36 months; men and women with greater than a high school education were more likely to be sustained nonsmokers.⁷ However, women with less than a high school education were significantly less likely to quit than men with similar education.

Smoking history variables also differed by gender. Men were more likely to have smoked for more years, to have greater than three prior quit attempts, and to have previously quit for more than 6 months. Women were more likely to have used Nicorette in the past and to live with another smoker.

Univariate analyses at 12 and 36 months showed that men who had smoked longer and had made more quit attempts were more likely to have quit than women. Women who had previously quit for less than 6 months were less likely to be sustained nonsmokers. However, women who had quit for more than 6 months in the past were more likely than men to be sustained nonsmokers. This suggests that, while women in the Lung Health Study may have been less persistent in their previous quit attempts, women who persisted longer were successful. These findings are consistent with those of Blake et al., who reported that women were often more tentative and less committed to quitting, which accounted, in part, for lower quit rates.³

No gender difference was observed among participants who lived with nonsmokers. However, when participants lived with smokers, women were less likely to quit than men. Gender differences in social support for smoking cessation have been reported by other investigators.^{12,20} In particular, Coppotelli and Orleans found that partner support was important for women.²¹ Women in the Lung Health Study were less likely than men to be married and more likely to be living with partners who smoked. Both characteristics may have considerably decreased partner support for women, making quitting smoking more difficult.

We also found gender differences in indicators of nicotine dependence. At baseline, men were heavier smokers with higher cotinine levels, and women reported greater physical and emotional dependence on cigarettes. While some variables indicate that men may be more nicotine dependent, women reported emotional and physical dependence, suggesting that they perceived their dependence on cigarettes as greater.

Univariate analyses at 12 and 36 months showed that members of both genders with higher cotinine levels were less likely to be sustained nonsmokers. However, women who were heavy smokers and more dependent on their first cigarette were less likely to be sustained nonsmokers than men with similar dependence. Smoking level and dependence on the first cigarette of the day are both established indicators of nicotine dependence,²² suggesting that women in the Lung Health Study with greater nicotine dependence had more difficulty quitting than men. These findings are consistent with those of Pomerleau et al., who reported possible gender differences in physical response to nicotine, resulting in differences in withdrawal and reduced quit rates among women.⁴ We found no gender differences at the higher levels of self-reported emotional and physical dependence. This suggests that, if women perceived their nicotine dependence at baseline to be greater than did men, this perception did not affect sustained quit rates.

Consistent with general population trends, women reported less alcohol consumption than men. However, when women reported greater than seven drinks per week, they were far less likely to be sustained nonsmokers than men with the same alcohol consumption. We also found that men with a higher body mass index were significantly more likely than women to be sustained nonsmokers at 36 months.

In the multivariate analysis, we found that gender did not predict sustained cessation at 12 months. At 36 months, gender reemerged as a predictor, partly as a result of a higher relapse rate among women between 12 and 36 months.

Higher relapse rates among women between 12 and 36 months have not been previously reported. In another Lung Health Study paper, we reported that living with smokers predicts relapse at 24 months for women but not for men.²³ In this paper, we have noted that social support is an important factor in smoking cessation for women. It is likely that living with smokers may be a relapse factor at 36 months as well. Likewise, the negative association found between prior use of nicotine gum and poorer quit rates has not been previously reported. This relationship may reflect the unwillingness of some participants to reuse nicotine gum after an unsuccessful prior experience.

Summary

Smoking cessation remains the intervention of choice for the prevention of chronic obstructive pulmonary disease and other smoking-related diseases. The Lung Health Study has demonstrated that significant sustained quit rates can be achieved in a large population of smokers with mild to moderate chronic obstructive pulmonary disease. However, the effectiveness of the intervention differs among men and women. Our analysis shows that gender differences in quit rates can be partly explained by baseline differences in education, marital status, and smoking history. Furthermore, gender differences were more pronounced in specific subgroups of participants defined by these characteristics. Although the Lung Health Study was a clinical trial of smokers with mild to moderate chronic obstructive pulmonary disease, these results are consistent with those of previous studies. The consistency of findings suggests that the Lung Health Study results can also help explain gender differences in smoking cessation rates in the general population.

On the basis of the results of the Lung Health Study, we believe that public health efforts to tailor smoking cessation programs by gender need to include training to improve coping skills for the problems associated with lower education and with the social support needs of women and unmarried smokers. We also believe that gender-specific programs need to combine skills training with better relapse prevention and longer follow-up to help female smokers achieve sustained abstinence and safeguard their health. □

Acknowledgments

This research was supported by contract N01-HR-46016 from the National Heart, Lung, and Blood Institute, National Institutes of Health.

We would like to acknowledge the generous support of Boehringer Ingelheim Pharmaceuticals Inc in providing Atrovent for the Lung Health Study and Marion Merrell Dow Inc in providing Nicorette for the study.

The principal investigators and senior intervention staff of the clinical and coordinating centers, the National Heart, Lung, and Blood Institute, and members of the Safety and Data Monitoring Board are as follows. *Case Western Reserve University*, Cleveland, Ohio: MD Altose, MD, AF Connors, MD, S Redline, MD, RF Rakos, PhD, C Deitz, PhD; *Henry Ford Hospital*, Detroit, Mich: WA Conway, Jr., MD, A Dehorn, PhD, CS Hoppe-Ryan, CSW, RL Jentons, MA; *Johns Hopkins University School of Medicine*, Baltimore, Md: RA Wise, MD, S Permutt, MD, CS Rand, PhD; *Mayo*

Clinic, Rochester, Minn: PD Scanlon, MD, RD Hurt, MD, DE Williams, MD, RD Miller, MD, LJ Davis, PhD, GG Lauger, MS; *Oregon Health Sciences University*, Portland, Ore: AS Buist, MD, JD Matarazzo, PhD, WM Bjornson-Benson, MPH, DH Gonzales, PhD; *University of Alabama*, Birmingham, Ala: WC Bailey, MD, CM Brooks, EdD, JJ Dolce, PhD, PG Greene, PhD, CC Crisp, BS; *University of California*, Los Angeles, Calif: DP Tashkin, MD, VC Li, PhD, MPH, M Nides, PhD; *University of Manitoba*, Winnipeg, Canada: NR Anthonisen, MD, J Manfreda, MD, RP Murray, PhD, VJ McCutcheon, MEd; *University of Minnesota Coordinating Center*, Minneapolis, Minn: JE Connett, PhD, PL Enright, MD, KJ Kurnow, MS, MO Kjelsberg, PhD, CJ Herzog, MS, WW Lee, MS, P Lindgren, MS, P O'Hara, PhD, HT Voelker, MS; *University of Pittsburgh*, Penn: GR Owens, MD, RM Rogers, MD, JJ Johnston, PhD, FP Pope, MSW; *University of Utah*, Salt Lake City, Utah: RE Kanner, MD, MA Rigdon, PhD, LJ Haas, PhD (the Salt Lake City Center has been assisted by the Clinical Research Center, Public Health Research Grant M01-RR00064 from the National Center for Research Resources); *National Heart, Lung, and Blood Institute Staff*, Bethesda, Md: SS Hurd, PhD, JP Kiley, PhD, MC Wu, PhD; *Safety and Data Monitoring Board*: M Becklake, MD, B Burrows, MD, P Cleary, PhD, P Kimbel, MD (deceased), L Nett, RRT (former member), JK Ockene, PhD, R Senior, MD, GL Snider, MD, WO Spitzer, MD (former member), OD Williams, PhD.

References

1. *The Health Consequences of Smoking for Women: A Report of the Surgeon General*. Washington, DC: US Dept of Health, Education, and Welfare; 1980.
2. Gritz ER, Berman BA. Women and smoking: toward the year 2000. In: Lisansky Gombert ES, Nirenburg TD, eds. *Women and Substance Abuse*. Norwood, NJ: Ablex Publishing; 1993:258-285.
3. Blake SM, Klepp KI, Pechacek TF, et al. Differences in smoking cessation strategies between men and women. *Addict Behav*. 1989;14:409-418.
4. Pomerleau CS, Pomerleau OF, Garcia AW. Biobehavioral research on nicotine use in women. *Br J Addict*. 1991;86:527-531.
5. Grunberg NE, Winders SE, Wewers ME. Gender differences in tobacco use. *Health Psychol*. 1991;10:143-153.
6. Pirie PL, McBride CM, Hellerstedt W, et al. Smoking cessation in women concerned about weight. *Am J Public Health*. 1992;82:1238-1243.
7. Pierce JP, Fiore MC, Novotny TE, Hatzian-dreu EJ, Davis RM. Trends in cigarette smoking in the United States: educational differences are increasing. *JAMA*. 1989;261:56-60.
8. Fiore MC, Novotny TE, Pierce JP, Hatzian-dreu EJ, Patel KM, Davis RM. Trends in cigarette smoking in the United States: the changing influence of gender and race. *JAMA*. 1989;261:49-55.
9. Pierce JP, Fiore MC, Novotny TE, Hatzian-dreu EJ, Davis RM. Trends in cigarette smoking in the United States: projections to the year 2000. *JAMA*. 1989;261:61-65.

10. Hatziaandreu EJ, Pierce JP, Lefkopoulou M, et al. Quitting smoking in the United States in 1986. *JNCI*. 1990;82:1402-1406.
11. Cohen S, Lichtenstein E, Prochaska JO, et al. Debunking myths about self quitting: evidence from 10 prospective studies of persons who attempt to quit by themselves. *Am Psychol*. 1989;44:1355-1365.
12. Fiore MC, Novotny TE, Pierce JP, Giovino GA, Hatziaandreu EJ, Newcomb PA, Surawicz TS, Davis RM. Methods used to quit smoking in the United States: do cessation programs help? *JAMA*. 1990;263:2760-2765.
13. Connett JE, Kusek JW, Bailey WL, O'Hara P, Wu M. Design of the Lung Health Study: a randomized clinical trial of early intervention for chronic obstructive pulmonary disease. *Controlled Clin Trials*. 1993; 14(2S):3-19.
14. Connett JE, Bjornson-Benson WM, Daniels K. Recruitment of participants in the Lung Health Study, II: assessment of recruiting strategies. *Controlled Clin Trials*. 1993; 14(2S):38-51.
15. Buist AS, Connett JE, Miller RD, et al. Chronic Obstructive Pulmonary Disease Early Intervention Trial (Lung Health Study): baseline characteristics of randomized participants. *Chest*. 1993;103:1863-1872.
16. Enright PL, Johnson LR, Connett JE, Voelker H, Buist AS. Spirometry in the Lung Health Study, I: Methods and quality control. *Am Rev Respir Dis*. 1991;143:1215-1233.
17. O'Hara P, Grill J, Rigdon MA, Connett JE, Lauger GA, Johnston JJ. Design and results of the initial intervention program for the Lung Health Study. *Prev Med*. 1993;22:304-315.
18. Murray RP, Connett JE, Lauger GG, Voelker HT. Error in smoking measures: effects of intervention on relations of cotinine and carbon monoxide to self-reported quitting. *Am J Public Health*. 1993;83:1251-1257.
19. *SAS/STAT User's Guide, Version 6*. 4th ed. Cary, NC: SAS Institute Inc; 1990.
20. Sorenson G, Pechacek TF. Attitudes toward smoking cessation among men and women. *J Behav Med*. 1985;10:129-137.
21. Coppelotelli HC, Orleans CT. Partner support and other determinants of smoking cessation maintenance among women. *J Consult Clin Psychol*. 1985;53:455-460.
22. Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. *Br J Addict*. 1989;84:791-800.
23. Nides M, Rakos R, Gonzales DH, et al. Predictors of initial smoking cessation and relapse through the first two years of the Lung Health Study. *J Consult Clin Psychol*. In press.

Call for Abstracts for the American Association of Public Health Dentistry 1995 Annual Meeting

The American Association of Public Health Dentistry (AAPHD) is inviting papers on a broad range of dental public health topics for presentation at its 58th annual meeting, October 4-6, 1995, Las Vegas, Nev. The theme of this year's meeting is "Oral Health: The Primary Care and Prevention Model."

Major topics include the following: access to services (among children, the uninsured, the homeless, the elderly, people with AIDS/HIV, etc.); trends in oral disease or conditions; baby-bottle tooth decay; prevention and educational measures; international, national, state, and local dental programs; delivery systems concepts and models; dental and medical services integration (especially in primary care

settings); quality assurance; infection control; tobacco intervention; military dental care; public/private partnerships; diversity in dental public health; and clinical advances in dental public health.

Abstracts will be evaluated and selected on the following criteria: significance, timeliness, originality, and quality of study design, writing, and supporting data.

The deadline for abstract submission is *May 1, 1995*. For a copy of the abstract form or further information, please write or call the AAPHD National Office, 10619 Jousting Lane, Richmond, VA 23235-3838; tel (804) 272-8344; fax (804) 272-0802.